The Quality of Development Index—
A New Headline Indicator of Progress

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Abstract

In this paper a new Quality of Development Index (QDI) is introduced and applied. The QDI provides a national-level measure of progress that reflects changes related to well-being, community, and the environment. The paper argues generally for a more explicit linkage between indicators of progress and values, and for a larger role for such indicators in quantitative scenario-based visioning exercises. Use of the QDI is suggested in place of the Gross Domestic Product, the current defacto headline indicator of progress.

Key Words: progress, indicator, scenario, visioning exercise, Gross Domestic Product

Introduction

Today Gross Domestic Product (GDP) is broadly accepted as the key indicator of progress. Fostering continuing growth in GDP is the focus of economic policy throughout the world. Non interference with that growth is a defacto requirement for policy in important areas such as climate change. Since the 1960s when GDP began to assume its current role, there have been discussions of its shortcomings. Among the most far-reaching of these was the Commission on the Measurement of Economic Performance and Social Progress (the Sarkozy Commission). The report produced by this effort (Stiglitz et al., 2010) provides a thorough critique of the use of GDP as an indicator of progress, but no specific suggestion for a replacement. Over the past 50 years there have been many efforts to develop replacements. While these play important roles in limited areas, none has come close to displacing GDP as the headline indicator of progress.

This paper introduces a new Quality of Development Indicator (QDI) and suggests its use in place of GDP as the headline indicator. The paper begins with a discussion of the idea of progress and the closely related areas of human well-being and utopias. This discussion situates the current, largely quantitative approach to progress within the broader, qualitative tradition. The paper next reviews the evolution of social indicators in general and economic and environmental indicators in particular. Drawing on this background, the design of the QDI is explained. The behavior of the QDI has been simulated for the period through 2100 using scenarios which depict a wide range of possible futures. Based on the structure of the QDI and the results of the simulation, the case for the QDI as a new headline indicator of progress is made and the implications of that choice are discussed.

A key feature of this paper is its discussion of the role of indicators in scenario analysis. Broadly speaking, scenario analysis involves the framing of alternative views of

the future in qualitative and quantitative terms. While scenarios sets are carefully constructed to cover a wide range of possibilities, using different indicators to summarize and evaluate the scenario results is generally not considered and so the impacts of indicator choice are not explored. In this paper two very different indicators—GDP and QDI—are used in conjunction with a set of four scenarios for development at the regional and global levels over the period through 2100. As this exercise shows, both the insights one gains from the scenarios and the judgments one might form based on them are significantly affected by the choice of indicators.

Progress

The idea of progress is a long-standing concern. The standard treatment focuses on the Western tradition, emphasizing philosophical, spiritual, economic, and social developments from the time of the ancient Greeks to the present day (Nisbet, 1979). However, progress is part of the broader area of moral, spiritual, and material improvement the treatment of which goes well beyond the Western tradition. This becomes clear in recent discussions of well-being, particularly its historical roots (McMahon, 2006) and its philosophical and spiritual context (McCready (ed.), 2001). What sets the idea of progress apart is an emphasis on advancement. While taking due note of the terrible abuses that have sometimes accompanied efforts toward progress in the past, Nisbet identifies the essentially optimistic nature of the idea:

> "We find the perspective of progress used, especially in the modern world, to give substance to the hope for a future characterized by individual freedom, equality, or justice."

It is the belief that among the vast number of possible futures there are good choices, and that humanity can choose wisely and well, that is central to the ongoing discussion of progress.

Historically the description of utopias has been an important aspect of the discussion of the idea of progress. What is a utopia? Drawing on a recent critical review of the concept (Rothstein et al., 2003), we may define it as an imaginary community, society, or world reflecting a substantially improved way of life, form of government, or social conditions. The articulation of utopias and their opposite, dystopias, provides a link to the study of futures. Indeed, a recent publication (Lempert et al., 2003) takes the development of utopias as the point of departure for its brief history of thinking about the future. Philosophical works such as Plato's *Republic* and works of fiction such as Bellamy's *Looking Backward* (Bellamy, 2000), provide the foundation for such thinking. Key works in futures studies such as *The Next 200 Years* (Kahn et al., 1976), combine narrative techniques, such as "the history of the future" found in *Looking Backward*, with quantitative analysis. There was a clear utopian element to Kahn's effort as Lempert et al. note.

In recent times much of the discussion about the future has been less than optimistic. Works such as the chilling recent novel *The Road* (McCarthy, 2007) depict dystopias rather than utopias. Further, the modern view of progress itself has become impoverished, focusing primarily on individual material well-being (*The Economist*,

2009). This impoverishment is apparent in the current discussion of utopias. Consider the Real Utopias Project, a self-described effort to sustain and deepen serious discussion of radical alternatives to existing social practices. In 2005 it devoted an entire volume to proposals that would ensure income sufficient to move all above the poverty line (Ackerman et al., 2006). While a world with all incomes above poverty is a worthy goal, it is hardly what the term "utopia" brings to mind. This impoverishment is also clear in recent well-known futures exercises, such as *Global Trends 2025: A Transformed World* (National Intelligence Council, 2008) which indicates how humanity might navigate some of the problems facing it today, but lacks the clear sense of possibility for real progress found, for example, in Kahn's work. This paper is premised on the notion that real progress is possible and indeed that there are many options for its pursuit. The challenge is to choose the best among them. The focus of this paper is on the development and use of indicators to aid us in meeting that challenge.

Indicators

To the modern mind, there is at least a quantitative aspect, and perhaps a quantitative focus to the idea of progress. But, as Nesbit makes clear, it is qualitative notions such as the "stages of history" found in Augustine's *The City of God* as well as the later works by Comte, Marx, Spencer, and others that are most common in the literature on the idea of progress. However, as one approaches the current period, quantification becomes increasingly important. Indeed, according to the director of the U.S. Bureau of the Census, "The 20th century can be described as the first `measured century´." (Prewitt, 2000). The increasing emphasis on quantification reflects three key developments: use of social indicators, widespread availability of macro-economic data, and increasing concern about the environment.

There are various senses in which the term "social indicators" can be used. Here we have in mind the broad usage in which social indicators are simply quantitative measures associated with various aspects of living and working conditions about which there is some degree of concern. Two examples drawn from the dawn of social indicator development and use in the 19th century make clear what is involved:

- *Temperance.* In the early 1800s, data on poorhouse and jail populations was developed by social reformers in the U.S. to show the adverse impacts of alcohol consumption (Cohen, 1982).

- *Public Health.* In the mid 1800s John Snow, an early English epidemiologist, collected data showing the correlation between the contamination of drinking water sources by fecal matter and the appearance of cholera (Riley, 2001).

By the early 1900s, a wide range of social indicator sets were in use in the U.S. They provided quantitative information relevant to education, recreation, public health, crime, and other issues (Cobb and Rixford, 1998). The development and use of such indicator sets continues to the present.

Social indicator projects routinely develop a wide range of indicators, each of which addresses a specific issue area. A "headline indicator" is often part of such sets. Headline indicators are common and important enough that the term has come to have a fairly clear meaning:

- A headline indicator provides simple, clear summary information to policymakers and the general public. It is suitable for inclusion in the headline of a newspaper article.

While the development of headline indicators is common in social indicator projects, there are instances in which their development is avoided. One of the best-known examples is the Calvert-Henderson Quality of Life Indicator Set (Henderson et al. (eds.), 2000). There the absence of a headline indicator is a conscious choice, made to foster transparency and the potential for use of the indicators in public education. There is nothing problematic in this approach. Indeed, it is taken in the OECD's annual social indicator sets where public information is a key focus of the effort (OECD, 2009) and in the indicator work by the U.N. in conjunction with the assessment of progress on the Millennium Development Goals Project (U.N., 2007b) in which each goal needs to be addressed separately.

Among social indicator sets, those relevant to the performance of a nation's economy hold a place of particular importance. The efforts of William Perry in the 17th century mark the beginning of the collection of data on key economic aggregates (Maddison, 2007). However, it was only with the post-WW II development and widespread adoption of a standardized System of National Accounts (SNA) that the regular development and publication of economic data by government agencies became common. Drawing on that data and supplementing it with information from private sources, the business press today routinely provides detailed quantitative information on the state of the economy. Those who follow economic affairs are so used to receiving this information that it comes as something of a shock to learn that it only became widely available in the 1950s.

Among the data produced using the SNA, GDP (adjusted of course to remove the effects of inflation) and the associated measure of income, GDP per capita, are of primary importance. Based on their behavior a world in which substantial continuing growth has become the norm comes into view. Figure 1 below shows how GDP, population and GDP per capita have changed over the last 500 years (Maddison, 2010). For most of that period change was slow. However, over the last 100 years and particularly the last 50, the pace of change has been remarkable.

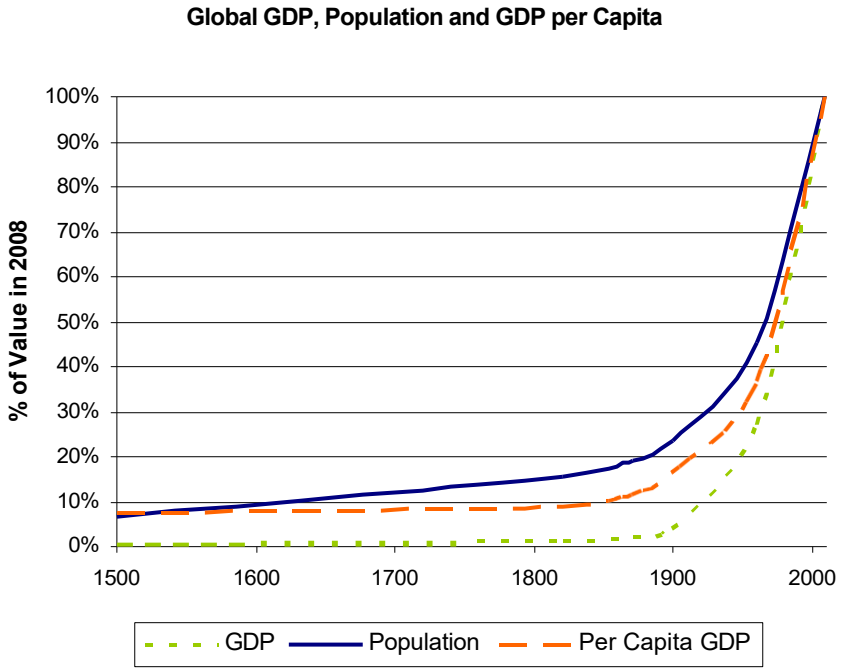


Figure 1. **Global GDP, Population and GDP per Capita (% of Value in 2008)**

The last 50 years have seen the emergence of GDP as the defacto headline indicator of progress. This development has not gone unchallenged. Responses have taken two basic forms:

- *Modification of the SNA*. A series of efforts, begun in 1972, have led to the development of the Genuine Progress Indicator (GPI) (Talberth et al., 2007), an alternative to the GDP based on a significantly modified system of national income accounting.

- *Inclusion of the GDP as one component of a broader index.* The Human Development Index (HDI), presented in the UN's annual *Human Development Report* (U.N., 2007a) takes GDP as the basis for one of its five component indicators.

The GPI and HDI are simply the best-known among a wide array of alternatives to the GDP (Schepelmann et al., 2010). The behavior of these alternatives often differs radically from that of GDP. For example, as the paper by Talberth et al. explains, for the U.S. the GPI shows no progress over the last 30 years, rather than the substantial gains registered by the GDP.

To a substantial extent, the challenge to the use of GDP as the headline indicator of progress has arisen from a concern about the impact of human activity on the environment. Going back thousands of years archeologists have shown that human activities—hunting and settlement and agriculture—have had a discernible impact on the environment (Costanza et al., 2007). However, throughout most of history there was little

or no concern about these impacts. In fact, changes in the environment such as the conversion of forests to farmland were seen as integral to progress. However, as the scale of the impacts associated with the industrial revolution came to be appreciated, this view began to change. The foreword to a well-known environmental history (McNeill, 2000) describes conditions found at the start of the 20th century:

> "Salmon could no longer migrate up-stream through chemical-tainted waters. The air surrounding industrial cities—and further afield, as the winds moved on—was full of particles of burned fossil fuels. Smog took the lives of thousands with respiratory problems each year. Huge gashes had been carved in the landscape to gain access to fresh coal supplies, and ugly heaps of slag blotted once-pleasant countrysides."

While the development of concern about the effects of human activity on the environment was somewhat belated, once it began it progressed quite rapidly. The International Institute for Sustainable Development takes the publication of *Silent Spring* (Carson, 1962) as the point of departure for its timeline, tracking the development of concern about the sustainability of human activity (IISD, 2006). By the mid 1990s sustainable development had become central to the discussion of progress and sets of indicators for it had been developed and implemented (OECD, 1998). The early 1990s saw the development of what is probably the best-known indicator of sustainability (or lack thereof), the Ecological Footprint. As is true of most indicators, there are many subtleties associated with footprint development and use. However, its developers describe the basic idea quite simply:

> "The Ecological Footprint is a measure of the demand human activity puts on the biosphere. More precisely, it measures the amount of biologically productive land and water area required to produce all the resources an individual, population, or activity consumes, and to absorb the waste they generate, given prevailing technology and resource management practices." (Ewing et al., 2008).

In the current global footprint land area accounts for 97 percent of the measure. Of that land the majority (52 percent of total) is forest area required to absorb CO_2 emissions. Most of the rest is utilized to provide food and materials for human consumption.

Consideration of the Ecological Footprint helps to counteract the marginalization of environmental concerns in standard economic analyses and the associated policy discussions. Rather than seeing the economy as a human activity embedded in and dependent upon the environment, economics treats the environment as an "externality," that is an appendage to our market-based economy which has as its primary focus the workings of supply and demand. The footprint turns our attention to the match (or mismatch) between the resources available to meet our needs and absorb our wastes and the demand for them implicit in human consumption. This moves the environment back toward the center of discussion.

The Quality of Development Index

Like the GPI, HDI, and Ecological Footprint, the QDI is an index, applicable at the national level, which can be used in place of the GDP as a headline indicator of progress. Its development grew out of the effort to evaluate and convey the results of a global quantitative modeling exercise conducted using the Tellus Framework discussed in the following section. The exercise involved the development of four very different, highly detailed scenarios covering the period 2005 to 2100. There was a desire to address the progress or lack thereof indicated by the scenario results. Of course, progress like beauty lies in the eye of the beholder. That is to say, the extent to which one sees progress or the lack thereof in a scenario depends on the values one holds and the extent to which the scenario results comport with them. Thus, to address progress, one should begin with a clear set of values. One then needs a mechanism to evaluate and express the degree of congruence between the scenario results and the values. The QDI and the social indicator set upon which its development is based provide that mechanism. Once the QDI was developed, it became clear that its use was in no way restricted to the Tellus scenario exercise that occasioned its development. In fact, it could replace the GDP in its role as the headline indicator of progress.

Viewed broadly, articulation of the QDI is a step in the ongoing effort to challenge the defacto acceptance of GDP as the headline indicator of progress. It builds on the HDI which was, itself, a conscious attempt to provide a broader and better balanced measure of progress than total or per-capita GDP (Stanton, 2007). The QDI is similar to the HDI in three respects: it is based on a specific set of values, it incorporates GDP in its development; and it is built up from a small social indicator set through a process of normalization and averaging. However, the QDI also differs from the HDI in some important ways. In the HDI, GDP accounts for a third of the index value while in the QDI it accounts for only a sixth. Unlike the HDI, the QDI takes account of change in the environment, providing roughly the same coverage as the Ecological Footprint and addresses community. These features of the QDI are discussed in a bit more detail later in this section. One might ask why, given the number of alternatives to the use of GDP that have been developed to date, Tellus chose to offer another. The reason is that, as noted above, the use of GDP or an alternative as a headline indicator of progress rests, explicitly or implicitly, on a set of values which define the notion of progress that the indicator reflects in its values. From its previous work Tellus had identified a set of values that were felt to provide an appropriate basis for a headline indicator. Neither GDP nor the available alternatives were based on those specific values. Thus, a new indicator was developed.

The remainder of this section discusses the development of the QDI in some detail. The emphasis in that discussion is on the values that underlie the index, the way in which they are operationalized in the social indicator set, and the procedures used to build up the QDI using that set. In the following two sections the Tellus Framework and scenario exercise is described briefly and then progress is evaluated by scenario, using both the GDP and QDI. This "head-to-head" comparison makes clear the substantial difference in the extent of progress one finds based on the two approaches. Examination of these differences leads to a consideration of the differences in values implicit in the use of the GDP and explicit in the QDI. Based on these value differences the final section

argues that the QDI should replace the GDP as the headline indicator of progress. Of course, it is to be hoped that the reader will concur in this judgment. In addition, it is hoped that the reader will gain some useful insights from the development of a value-based indicator and from the use of "head-to-head" comparison as a part of a scenario evaluation process.

The QDI was developed with three key points in mind:

- **Values.** The index is based on a specific set of values—individual well-being, community, and the environment. As others have noted these values reflect a broad consensus about what matters today (Hughes and Hillebrand, 2006).

- **Structure.** The design of the index balances breadth against simplicity and transparency, in an effort to produce an index that is both wide in coverage and easy to understand.

- **Quantification.** The metrics chosen for the individual indicators that are combined to produce the QDI need to utilize data which is readily available for the past and can be developed in scenarios for the future.

The structure of the QDI is set out in the table below. As the table shows, there are two indicators associated with each of the three values on which the QDI rests. The metric used for each indicator is identified. Below we will work through each of the values, explaining the basis for the associated selection of indicators and metrics. At the end of the section we will briefly discuss the mechanics of assembling the QDI from its component parts.

Table 1: Structure of the QDI

Values	Indicators	Metrics
Well-being	Prosperity	Log (GDP per Capita)
	Time Affluence	Average Annual Hours of Work
Community	Social Cohesion	Gini Coefficient
	Poverty Reduction	% Hungry
Environment	Climate	CO_2 per Capita
	Ecosystems	Forest & Protected Land

The first value reflected in the QDI is well-being. Prosperity, the first of the indicators associated with well-being, addresses the concerns implicit in the adoption of GDP as the headline indicator of progress. As the OECD notes, GDP per capita is the principal measure of material living standards (OECD, 2010). The U.N. adopts a broader point of view, noting in its *Human Development Report* that inclusion of the logarithm of GDP per capita in its HDI "serves as a surrogate for all the dimensions of development

not reflected in a long healthy life or knowledge." The QDI follows the U.N. approach, including log (GDP per capita) as the metric for prosperity. In addition to the general argument based on diminishing returns (Ackerman et al., 2010), this choice relies on an expanded version of the U.N.'s surrogate argument:

- The Preston Curves, well known to researchers in public health, show that across nations gains in life expectancy at birth track the logarithm of GDP per capita (Markle et al., 2007).

- Recent statistical analyses show that across nations the average level of subjective well-being ("happiness") increases with log (GDP per capita) (Deaton, 2008).

The situation is more complex if one looks at average happiness levels for one nation over time. Recently a major effort was made to demonstrate a positive statistical relationship between average income at the national level (i.e., real GDP per capita) and well-being. No relationship was found for the U.S. However, evidence linking gains in well-being with growth in income was found for Japan and Europe (Stevenson and Wolfers, 2008). These results provide a sufficient rationale for the use of log (GDP per capita) as one of the indicators of individual well-being.

The treatment of well-being in the QDI also includes an indicator for "Time Affluence." This addresses an issue that was discussed in a recent *New York Times* article (Gertner, 2010). The article compared two hypothetical individuals, High- and Low-G.D.P. Man. The first earns a high salary and uses it to pay for services and purchases the best of everything. The second works, earns and spends less. After describing the two, the article compares them:

> "By economic measures, there's no doubt High-G.D.P. Man is superior to Low-G.D.P Man. His salary is higher, his expenditures are greater, his economic activity is more robust. You can even say that by modern standards High-G.D.P. Man is a bigger boon to his country. What we can't really say for sure is whether his life is any better."

The difficulty, pointed out by Gertner in his article, is that the consideration of prosperity alone does not allow one to address the trade-off between time and money illustrated by High- and Low- G.D.P. man. In the QDI that trade-off is addressed through the introduction of an indicator for time affluence. The importance of including this feature is made clear in the recent work of Juliet Schor (Schor, 2010). The details of the trade-off are discussed in the section on the behavior of the QDI's components.

The second value addressed by the QDI is community, that is our sense of social cohesion. Its inclusion in the QDI is consistent with current-day notions of utopia.

> "Asked to outline a utopia today, the typical Western citizen might say the abolition of poverty; a big house and car for everyone, and no money worries; eat and drink what you want without gaining weight; live 150

> years; more sex (for men) and more romance (for women); television remote-controls that find themselves; global peace and larger airline seats." (Easterbrook, 2003).

Easterbrook captures the current focus on individual material well-being in a way that is either humorous or offensive depending on one's sensibilities. However, he also makes it clear that, in a utopia, material well-being is for "everyone." This shows a sense of and concern with social cohesion, the first of the two aspects of community addressed by the QDI.

As the Council of Europe points out in its benchmark definition, social cohesion is "society's ability to secure the long-term well-being of all its members." (Council of Europe, 2005). The Council's definition brings equality squarely into the picture. The broad range of ways that equality contributes to social cohesion and inequality eats away at it has been spelled out in a number of books (Wilkinson and Pickett, 2009; Wilkinson, 2005). Use of the Gini Coefficient, a common measure of the extent of income equality as a measure of social cohesion, is supported by the work of well-known development economists (Easterly, 2006; Rodrik, 1999). Just as ln (GDP per capita) captures a wide range of material, physical, and social well-being, so the Gini Coefficient captures a wide range of concerns related to social cohesion. For example, consider trust. Wilkinson and Pickett have investigated the relationship between equality in income, measured using the Gini Coefficient, and the general level of trust, based on survey responses to a question asking whether most people can be trusted. Their data shows that, on average, as the level of equality measured by the Gini Coefficient falls so does the percent agreeing most people can be trusted.

In addition to equality, the treatment of community in the QDI focuses on poverty reduction, and particularly on hunger. This focus is supported by two observations:

- John Rawls' influential theory of justice gives special consideration to the least advantaged members of society (Rawls, 1971).

- The first of the U.N.'s millennium goals is to eradicate extreme poverty and hunger (U.N., 2007a)

Rawls' theory and the U.N. goals both focus attention on those who are truly at the bottom. Hunger characterizes the very bottom group far better than broader metrics such as the World Bank's poverty lines (Reddy and Pogge, 2002).

Finally, there is the environment. Here the treatment in the QDI follows that in the Ecological Footprint CO_2 emissions are a key concern. However, rather than looking at the forest area required to offset emissions as the footprint does, one of the indicators used to develop the QDI is based directly on emissions per capita. While one might argue that total emissions rather than per-capita levels would better reflect climate concerns, it was felt that consistency with the treatment of prosperity and with discussions of climate equity which addresses emissions on a per-capita basis made the per-capita treatment in the QDI the more appropriate choice. The treatment of environment in the QDI also

includes an indicator that picks up the extent to which "nature" (i.e., biodiversity, underdeveloped land, etc.) is preserved. This deals with the same issues as the non-climate portion of the footprint. And, like the footprint, it leaves out a good deal. A recent paper on ecological limits identifies eight "planetary boundaries" that should not be crossed (Rockstrom et al., 2009). However, taking seriously the need for simplicity and transparency, the approach taken in the development of the QDI is on balance reasonable.

Thus far discussion has focused on the individual metrics used to address the three values. To complete the discussion, the procedures used to transform data developed using the metrics into indicators, to combine those into composite indicators associated with each of the three values and then, finally, to combine the three composites into the QDI need to be explained. The procedures used to develop the HDI guide this process (U.N. 2007b). The first step is to transform each of the six metrics into an indicator which runs from 0 to 1 as the values of the metric "improve." There is a standard method for this transformation. Assume that a metric (M) runs between lower and upper limits (L and U, respectively), and that an increase in M is associated with improvement. In this case the indicator is simply (M-L)/(U-L). If a decrease is associated with improvement, the formula for the indicator changes to (M-U)/(L-U). Composite indicators associated with the values are then computed as the average of the two indicators associated with each value. Finally, the QDI is computed as the average of the three value-related composites.

As the preceding discussion shows, the QDI has the same general structure as the U.N.'s HDI. Like the HDI, the QDI is the average of three composite indicators, each of which is itself the average of individual indicators. All of the elements of the social indicator set—the QDI itself, the composite indicators associated with the three values, and the six individual indicators—vary between 0 and 1 with increases indicating improvement. This alignment of range and direction of improvement provides the simplicity and transparency desired for the QDI. Coverage of environmental concerns comparable to the Ecological Footprint as well as community adds dimensions absent from the HDI, but crucial for the breadth sought in the QDI. The QDI can be viewed on a stand-alone basis, as a proposed replacement for GDP in its role as the headline indicator of progress or more modestly as simply another indicator to be considered alongside of GDP, GPI, HDI, and others.

The design of the QDI continues the process of reducing the weight accorded to GDP per capita in the assessment of human development that began with the development of the HDI. For those interested in human development, growth in GDP per capita has long been an "overarching preoccupation" (Drèze and Sen, 1995, p. 9). Development of the HDI was an important step away from this preoccupation and toward a broader and more balanced approach (Sen, 2000). GDP per capita determines only a third of the value of the HDI. Still, in the HDI one has GDP per capita as the sole measure of affluence. In the design of the QDI affluence is broken into time and monetary components. GDP per capita determines the monetary component, but that component accounts for only a sixth of QDI value. Thus, by taking account of both time and money, the weight given to GDP per capita in the HDI is cut in half in the QDI.

The Tellus Framework

In addition to values and structure there is a third point, quantification, which shaped the development of the QDI. It is reflected in the specific metrics chosen for the six indicators upon which the development of the QDI rests. The metrics chosen make the QDI uniquely useful in long-term scenario exercises. To appreciate this, an understanding of the Tellus Framework, and the place of the QDI in it, is required. The Tellus Framework consists of four scenarios for the years 2005 to 2100 and a computer modeling system, PoleStar, designed for use with them. This framework allows Tellus to combine narrative techniques with quantitative analysis as seen, for example, in Kahn's work discussed earlier, providing a rich and detailed view of possible global futures. To explain the framework we begin with the "story lines" for the scenarios.

The four scenarios included in the Tellus Framework provide distinctly different views of the way in which the next 100 years might unfold across the globe and in its major regions. The first two are referred to as Conventional Worlds. They reflect continuation of developments seen in recent decades, particularly high rates of global economic expansion. In these scenarios, poor countries gradually converge toward the consumption and production patterns of rich nations as their incomes rise and the cultural and social influences of globalization spread. However, while the Conventional Worlds share many features, they also differ in certain key respects.

- **"Market Forces."** This is a scenario in which free market optimism proves well-founded. The continuing pursuit of economic growth via free trade and competitive markets is successful. Average global incomes increase substantially, even as population expands. As a result, the global economy grows dramatically. Regulatory efforts to address the social and environmental impacts of this growth are "light handed."

- **"Policy Reform."** As in Market Forces, this scenario assumes no major changes in the international order rooted in the nation-state, current institutional structures, or in the dominant consumerist cultural values. However, unlike Market Forces, it does assume that governments introduce effective policies to direct and shape the path of economic growth, thereby achieving ambitious goals in the areas of poverty reduction, climate change, ecosystem preservation, water supply adequacy, and pollution control.

Market Forces and Policy Reform are "conventional" in the sense that they evolve gradually in response to the forces and developments that shape our world today. The other two scenarios assume fundamental change: regression in Fortress World and transformation in Great Transition.

- **"Fortress World."** What if market-driven adaptation or policy reform are tried and prove unsuccessful? Fortress World reflects one possibility. In it powerful forces, faced with dire systemic crises, impose an authoritarian

order. Elites retreat to protected enclaves where they enjoy a Western lifestyle, leaving impoverished masses outside.

- **"Great Transition."** This scenario envisions a different response to crisis. The emergence of more equitable social arrangements and effectual institutions for global governance provide the social and environmental gains achieved through technological improvement and government policy in Policy Reform while more modest lifestyles reduce the growth found in the Conventional Worlds scenarios.

As the narrative that describes the Tellus scenarios (Raskin et al., 2002) makes clear, they provide a set of alternative futures, based on different mixes of trends, emerging issues, challenges and opportunities.

In all of the Tellus scenarios there is some growth in GDP and GDP per capita. In Market Forces and Policy Reform, this growth is substantial, as one would expect. Recent decades have seen such growth. These "conventional" scenarios continue it with greater or lesser government efforts to address public policy concerns. While the other two scenarios incorporate some growth, the focus and indeed the driving force is income distribution. In Fortress World there is a dramatic reduction in growth accompanied by massive increases in inequality due to systemic crises and the associated shifts. What about the Great Transition? This scenario embodies a strong shift toward equity. The spread in GDP per capita drops from about $39,000 in 2005 to roughly $4,000 in 2100. One could, of course, have such a scenario in which the global average income drops to levels far below those in North America, Western Europe, and the wealthy nations of the Pacific Rim today. However, that was not the choice made. Convergence is at about the level of GDP per capita seen in Western Europe today. The Great Transition assumes "no growth" (in fact reductions) for the rich, but allows substantial growth for the poor.

The second part of the Tellus Framework is the PoleStar System, a collection of computer programs and data structures originally designed in the early 1990s by the Tellus Institute and the Stockholm Environment Institute. Named for the star that guided explorers through uncharted waters, the PoleStar System is a comprehensive, flexible analytic platform and resource-accounting framework that aids in the elaboration of long-range scenarios. The four current Tellus scenarios, used in conjunction with PoleStar, are updates and enhancements of an earlier, well-known and widely used scenario set developed by the Tellus Institute on behalf of the Global Scenario Group (Samet, 2008). PoleStar together with the earlier Tellus scenarios was used in projects conducted for the United Nations Environment Programme, the Organisation for Economic Cooperation and Development, and the U.S. Environmental Protection Agency (Raskin, 2004). In the current set the base year has been advanced from 1995 to 2005, adding ten additional years to the historical data on which the scenarios rest. PoleStar has been used to model four current Tellus scenarios in great detail, analyzing major sectors and subsectors of the economy and numerous aspects of environmental and natural resource impacts for eleven world regions. Table 2 below identifies specific areas addressed. An overview of the results of Tellus' recent scenario exercise is available in a recent paper (Raskin et al.,

2010). Additional detail is provided in the technical documentation for the PoleStar-based analysis (Electris et al., 2009).

Table 2: Key Areas Addressed in PoleStar

Sector	Issue
Social	• Population • Gross Domestic Product (GDP) and value-added by sector • Income (GDP per capita) • Income distribution within and between regions • Poverty • Hunger line (income for adequate diet) • Employment (productivity and length of work week)
Household	• Energy use by fuel • Water use • Air pollution • Water pollution
Service	• Energy use by fuel • Water use • Air pollution • Water pollution
Transportation	• Passenger by mode: public road (buses, etc.), private road, rail, air • Freight transportation in following modes: road, rail, water, air • Energy use by mode and fuel • Air pollution
Agriculture	• Diet by crop and animal product categories • Livestock: animal type, seafood (wild, farmed), other products (milk, etc) • Crops: coarse grains, rice, other (fruits, vegetables, etc.), sugarcane, biofuels • Energy use by fuel • Irrigation • Fertilizer use • Air pollution • Water pollution
Industry	• Energy use by fuel and subsector: iron and steel, non-ferrous metals, stone, glass, and clay, paper and pulp, chemical, other • Energy feedstock by subsector. • Water use by subsector • Air pollution from both fuel combustion and process • Water and toxic pollution
Forestry	• Primary wood requirements • Secondary wood for final demand, and input to paper and pulp, lumber, biofuel
Land-Use	• Conversions between built environment, cropland, pasture, forest types (unexploitable, exploitable, plantation, and protected), other protected (marshes, bays, etc.), other • Each category broken down by arable and non-arable areas • Cropland disaggregated by crop type, and irrigated/non-irrigated
Energy Conversion	• Conversion from primary to secondary fuels (i.e., electricity production and oil refining) • Requirements for coal, biomass, natural gas, renewable (wind, solar, geothermal, etc), crude oil, nuclear, hydropower • Air pollution
Water	• Freshwater resources • Desalinization and waste-water recycling for water resources • Use-to-resource ratios • Water stress
Solid Waste	• Generation from household and service sectors • Landfill, incineration, recycling and other disposal technologies • Energy generation from incineration

Three of the four scenarios included in the Tellus Framework clearly frame versions of progress in humanity's future. The scenarios differ simply in the way progress is conceived. Each of the scenarios is utopian in the sense that the type of progress sought is achieved. In Market Forces, there is convergence of the entire world toward the levels of affluence seen in the West. Policy Reform and Great Transition achieve substantial gains in social and environmental areas. Fortress World portrays dismal prospects: collapse of civilized norms and degradation of the natural world. However, as we will show below, there is progress of a certain type associated with even this scenario.

The Tellus scenarios offer a range of options. How might individuals and policy-makers decide which they favor? To make this choice wisely one needs to have a sense of the impact that adoption of different indicators would have. Today, there is a serious critical discussion of our current, de facto headline indicator—GDP. Throughout this discussion one looks in vain for head-to-head comparison of the assessments that GDP and other possible headline indicator choices would produce. Scenario-based exercises usually begin with the choice of a headline indicator, typically "economic growth" (i.e., GDP in total or per capita) but sometimes "emissions" (i.e., production and release of greenhouse gases and their accumulation in the atmosphere). In these exercises, there is generally no attempt to examine the effect of choice of headline indicator on the scenario ranking. The development of the QDI addresses this point.

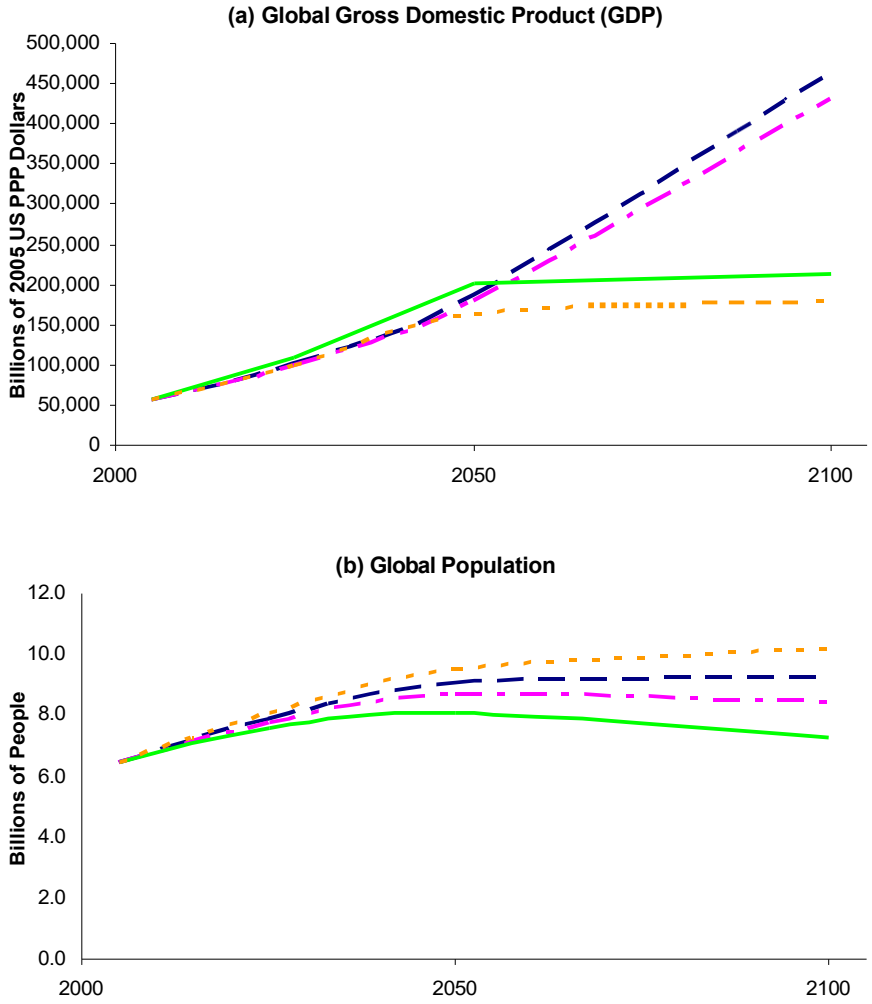
Development of the QDI and the social indicator set upon which it is based adds a third element to the Tellus Framework. It now consists of scenarios, a modeling system, and a headline indicator. Two things are gained by this enlargement. Within the Tellus Framework there is now a clearly specified basis upon which to organize and present the scenario results, making them more accessible to policymakers and the public. Going beyond the Tellus Framework, development of the QDI suggests a general possibility for quantitative, scenario-based visioning exercises. Such exercises could be expanded to include the selection or development of one or more headline indicators and associated social indicator systems. Application of this machinery would formalize the process of examining scenario results from different points of view, with an eye to gauging the type and extent of the progress they embody. The following section illustrates this approach. It provides the results of such a "head-to-head" comparison: the four Tellus Scenarios are examined, first using the current headline indicator, GDP in total and per capita, and then using the QDI.

Scenario Evaluation and Ranking

Figures 2(a), (b), and (c) below provide an overview of the four scenarios, based on the current headline indicator. The figures show the behavior of the GDP, population, and income (i.e., GDP per capita). As 2(c) shows, income soars in both Policy Reform and Market Forces, but stagnates in Fortress World as the majority of the world's population becomes mired in poverty. Income grows up until 2050 in Great Transition as strong commitments to equity spur rapid economic development in the global South. After 2050, as greater equity is achieved, growth moderates, regional incomes converge, and the world moves toward a steady state economy.

As indicated in Figure 2(b), across the four scenarios, world population grows substantially, to between 7.2 and 10.2 billion in 2100 up from 6.5 billion in 2005. Most of the increase is in developing regions. In all of the Tellus scenarios as in most population projections, there is anticipated reduction in population growth due to the continuing demographic transition. This transition is accelerated in Policy Reform and particularly in the Great Transition, and delayed in Fortress World, where the process of development is truncated. 2(a) combines the results on income and population to show the path of global GDP. It is roughly similar to that of GDP per capita.

Today growth in GDP and income are the key concerns. From that perspective Market Forces and Policy Reform are roughly comparable and greatly preferable to the other scenarios. The results of Policy Reform are likely to be particularly attractive to those who, like the OECD staff, emphasize GDP per capita as a basic measure of the standard of living, but look for policy-driven gains in social and environmental areas as well. Deep change such as that associated with the Great Transition would not be attractive because, as shown in Figure 4 c), it significantly reduces the growth in income and so in GDP over the long run.



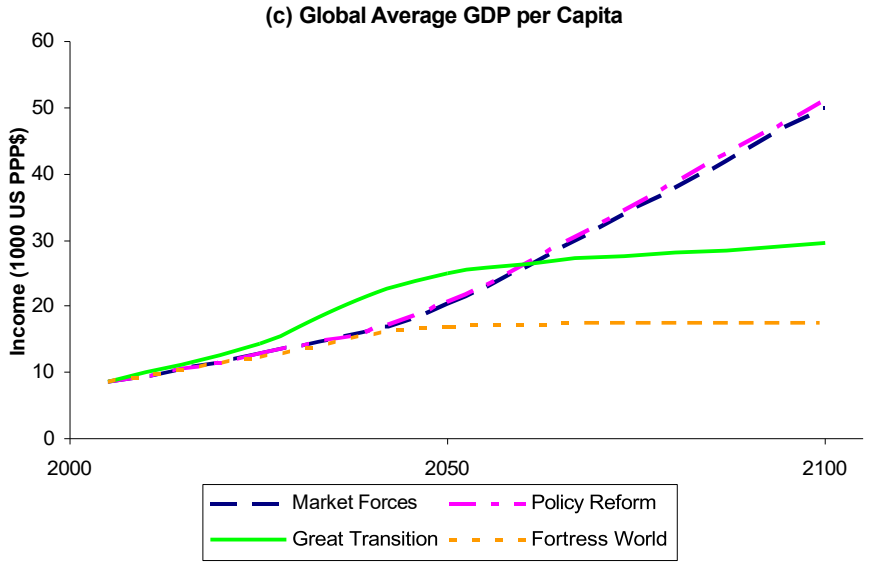


Figure 2. **(a) Global Gross Domestic Product (GDP), (b) Global Population, (c) Global Average GDP per Capita**

Among the most interesting features in Figure 2 are the results for Fortress World. Income grows modestly compared to the other scenarios. However, because of the high population growth, GDP growth is robust. Thus, if one puts on blinders, ignores the narrative describing the scenario and instead focuses only on the results in Figures 2 a) and c), Fortress World joins the other three scenarios as an instance of "progress, at least as indicated by GDP.

The results in Figure 2(c) highlight a key difference between the two conventional world scenarios and the others. In the former, growth continues strongly over the entire scenario period. Indeed, much of the gain in GDP per capita occurs during the second half century. This is what one expects in scenarios where economic growth remains the focus and driving force. In the other two scenarios growth in GDP per capita is confined to the first half century. For Fortress World this is a transition to a world in which oppression and economic stagnation dominate. In the Great Transition, 2050 marks the end of growth for the wealthy and rapid growth for the poor. Continuing convergence with equity proceeds during the second half of the scenario period.

How do the four scenarios compare, based on the QDI rather than GDP? Figure 3 begins to address this question. It shows the QDI for each scenario, developed based on global data. Three key differences from the assessment based on GDP emerge in the figure:

- Based on the QDI the Great Transition is clearly a better choice than either of the two Conventional Worlds.

- Between the two Conventional World Policy Reform is clearly better than Market Forces, rather than roughly the same as it was based on GDP.

- Fortress World remains at the bottom. However, based on the QDI it shows a decline rather than the progress indicated by GDP.

As these differences make clear, the QDI provides a very different evaluation of the possible futures portrayed in the Tellus scenarios than does the current headline indicator.

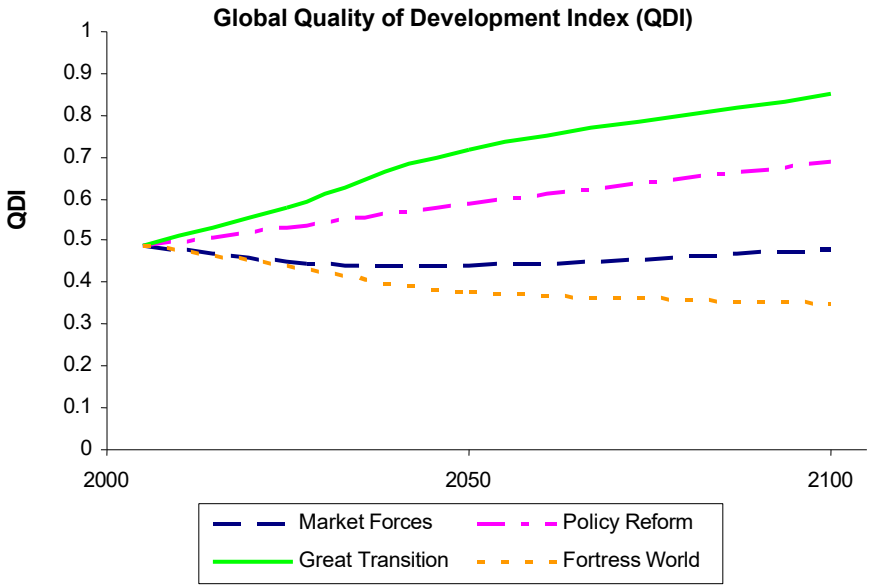


Figure 3. **Global Quality of Development Index (QDI)**

In the following section the QDI results will be "unpacked," examining the behavior of the composites associated with the three values on which the QDI rests and the six separate indicators on which they in turn are based. First, however, a brief discussion of the behavior of the QDI across the regions of the globe is provided, to round out the discussion of the QDI as a whole. Using PoleStar, the evolution of the four scenarios is developed for each of 11 global regions. Figure 4 summarizes the results of this exercise. For 2005, the Base Year (BY), the figure shows the high, low, and average values for QDI. The range is substantial. Moving to 2100, the final year simulated, the figure shows the high, low, and average values for each of the four scenarios. Key features of the regional-level data are the following:

- The regional results for Market Forces (MF), Policy Reform (PR), and Great Transition (GT) all show gains in the average level of QDI. Only Fortress World (FW) shows a decline. The regional-level data confirms what the global-level QDI data in Figure 3 shows; there are a variety of ways progress might occur but, based on the QDI, Fortress World isn't one of them.

- The ranking of the scenarios with respect to gains in QDI is generally the same at the regional level as it was at the global level. For Market

Forces the regional data underlines the minimal nature of the gains: QDI values in 2100 are well within the current (i.e., 2005) range. For Policy Reform the gains are more substantial, but far less than those for the Great Transition.

- In 2100 the range of QDI values for all scenarios is less than in 2005. This reflects the convergence due to continuing globalization reflected in varying ways in the design of all the Tellus scenarios.

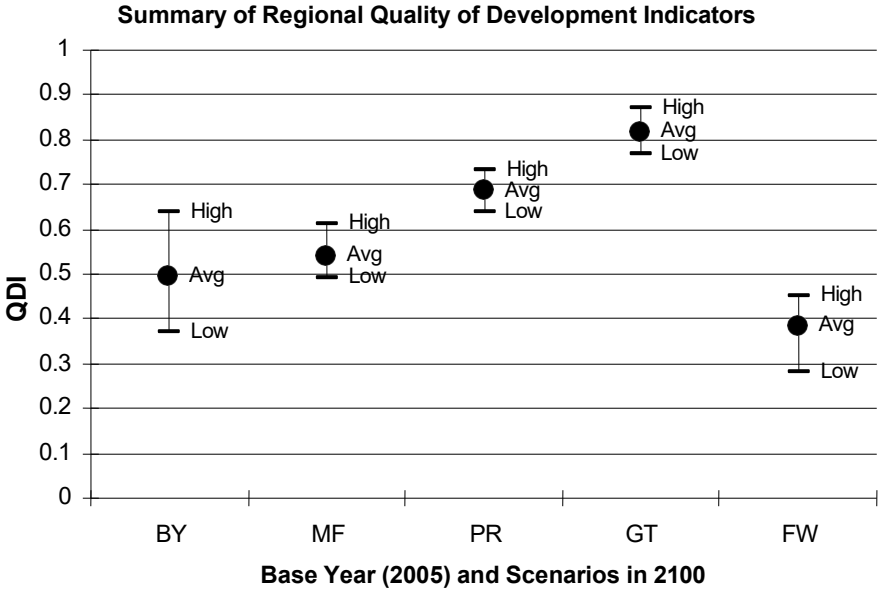


Figure 4. **Summary of Regional Quality of Development Indicators**

Behavior of the QDI Components

While the structure of the QDI is relatively simple, it does reflect three different values, each of which is associated with two indicators. For four scenarios, this means that 24 time series are required to fully describe QDI behavior. Figures 5, 6, and 7 convey this information. Each figure addresses one of the values on which the QDI rests, with parts (b) and (c) showing the individual indicators associated with that value. Part (a) in each figure is the average of (b) and (c). Thus, it shows the behavior of the composite indicator for each value. Averaging the composites produces the global QDI shown in Figure 3 above.

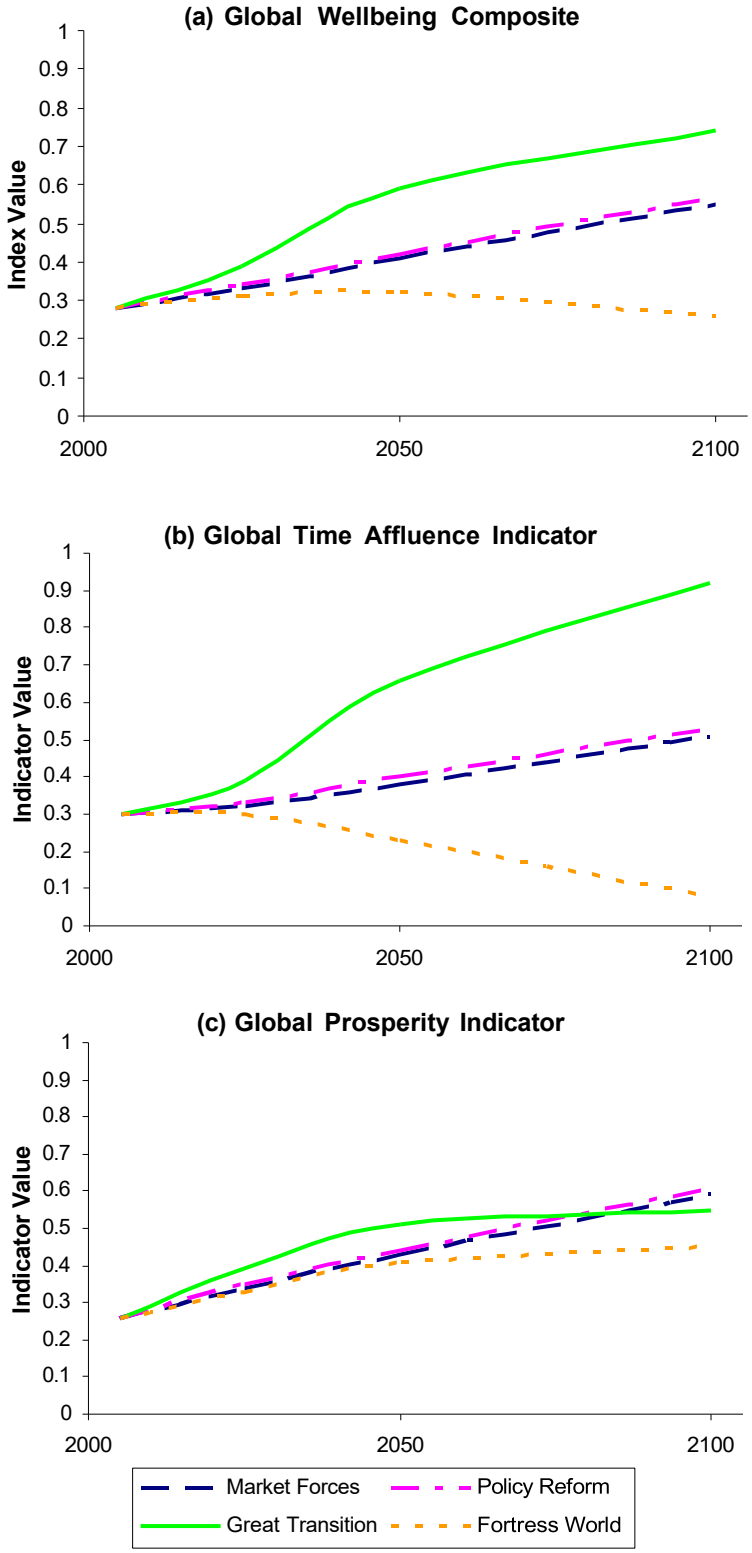


Figure 5. **(a) Global Wellbeing Composite, (b) Global Time Affluence Indicator, (c) Global Prosperity Indicator**

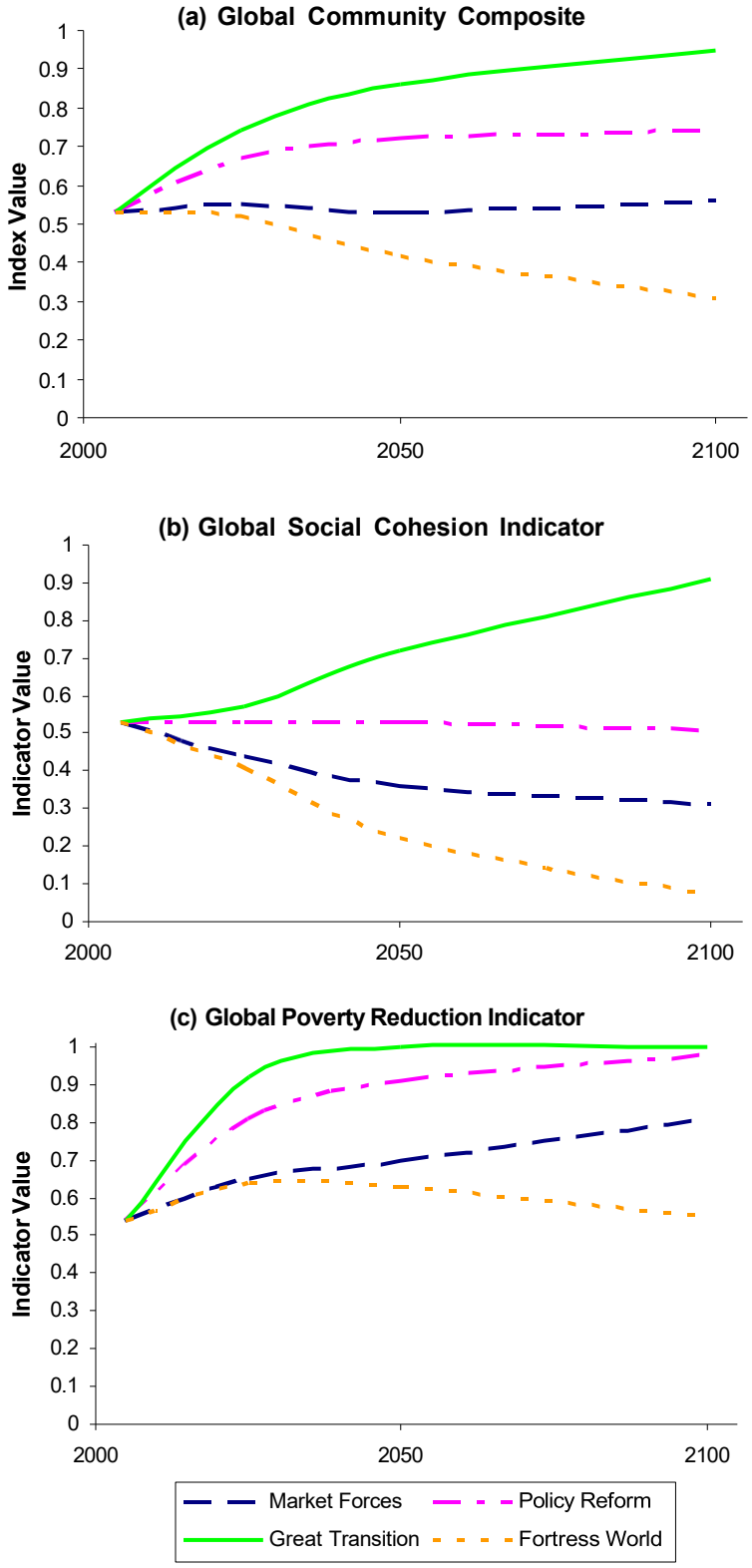


Figure6. **(a) Global Community Composite, (b) Global Social Cohesion Indicator, (c) Global Poverty Reduction Indicator**

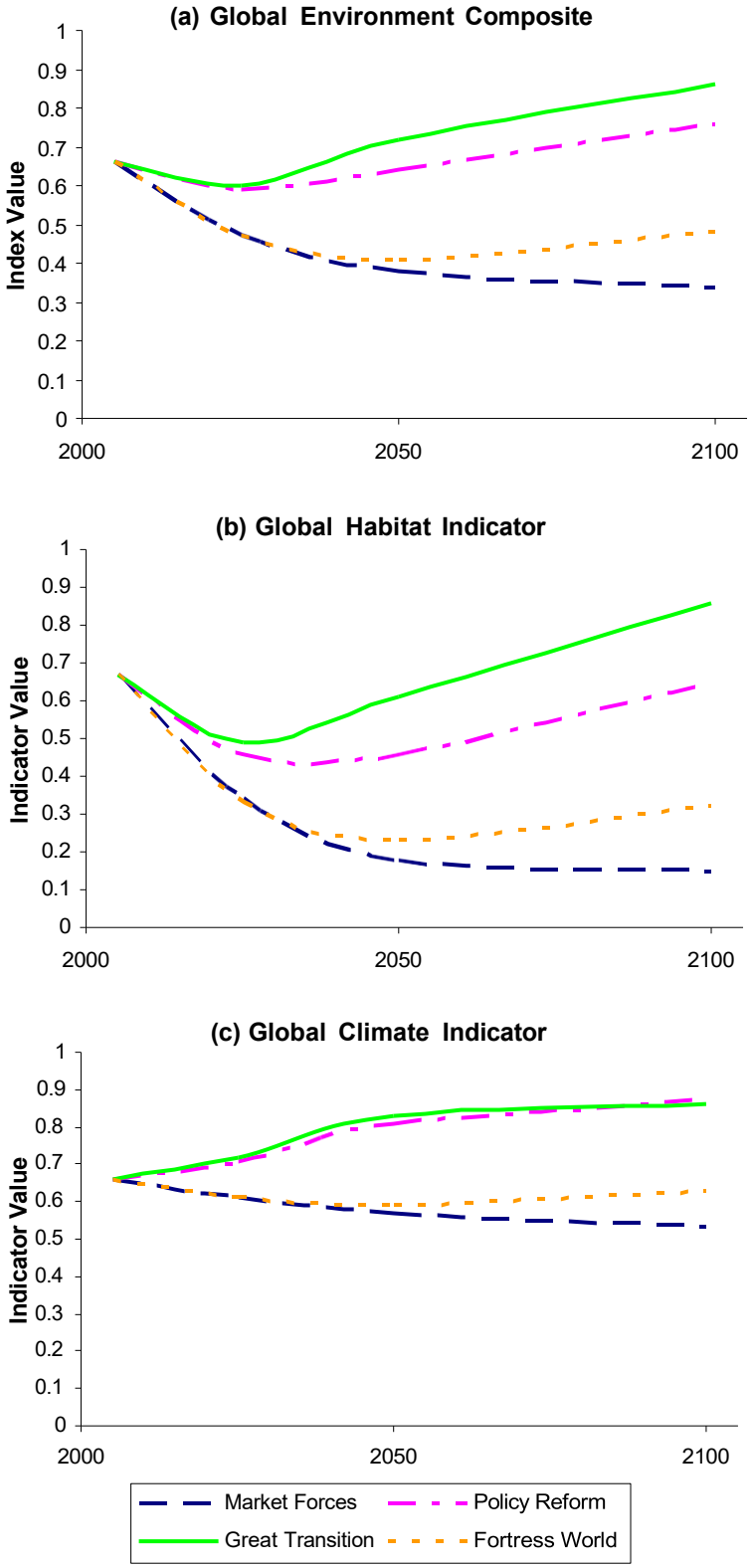


Figure 7. **(a) Global Environment Composite, (b) Global Habitat Indicator, (c) Global Climate Indicator**

Turning first to well-being, one sees that the behavior of prosperity shown in Figure 5(c) is qualitatively similar to that of GDP per capita as shown in Figure 3. But, due to the use of logs, the variation among the scenarios is greatly reduced. The variation due to time affluence shown in Figure 5(b) is much more substantial. It is time affluence, not prosperity, that has the major effect on the behavior of the well-being composite shown in Figure 5(a). To explain what is going on here, consider a simple example based on the behavior of prosperity in the Great Transition scenario. How would well-being measured using the QDI approach be affected by a shift to half-time for a U.S. worker currently paid $80,000 year for a 40-hour week? Going to half-time doubles the time affluence of the worker. However, because of the log-linear specification, the worker's prosperity falls by only about 15 percent. The mirror image of the effect illustrated in this example can be seen in the behavior of well-being in Fortress World in Figure 5. The prosperity indicator rises, driven by the growth in the global average GDP per capita that is part of the scenario. However, the hours of work also rise, driven by the worsening conditions outside the elite enclave which force the majority to lengthening hours just to provide the necessities of life. This causes the time affluence indicator to fall substantially. Combining the two, Fortress World shows a modest decline in well-being rather than the modest improvement that use of GDP as the headline indicator suggests.

Moving on to community, both of the individual indicators have substantial impacts. However, they behave in very different ways. Based on the indicator for social cohesion shown in Figure 6(b), only the Great Transition scenario shows gains. Policy Reform is close to neutral while both Market Forces and Fortress World show losses. Why does this happen? In Market Forces the global free market is assumed to raise both the average global GDP per capita and the inequality in GDP per capita as well. Policy Reform offsets this growth in inequality while the split into elites and impoverished masses seen in Fortress World exacerbates it. It is only with the emergence of more equitable social arrangements and the broad adoption of more modest lifestyles in Great Transition that any real gains occur.

To see how global equality differs over the four scenarios, it is helpful to examine results based on a simpler, less technical measure than the Gini Coefficient. Figure 8 provides a comparison of average incomes in the current high (i.e., OECD) and low income (i.e., non-OECD) across the Tellus scenarios. The differences in the movement toward equality are striking. The Gini Coefficient, upon which the results shown in Figure 6(b) rest, picks up these differences as well, leading to a spread similar to that in Figure 8.

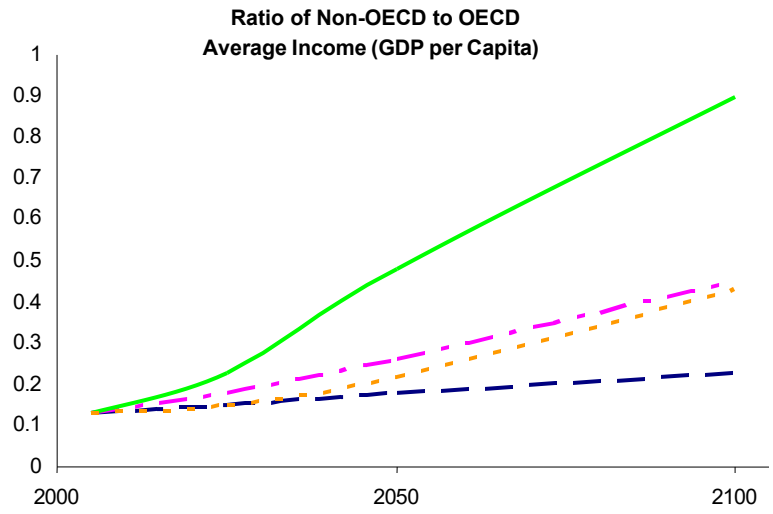


Figure 8. **Ratio of Non-OECD to OECD Average Income (GDP per Capita)**

The results for the poverty reduction indicator, shown in Figure 6(c), indicate that all the scenarios, even Fortress World, result in some gains. These gains reflect the fact that, as in the U.N.'s Millennium Goals, the QDI reflects the percent not the absolute number hungry. If one focuses on the number who are hungry, the picture changes as shown in Figure 9 below. Consider, for example, the difference in the pace at which hunger is reduced in Policy Reform and Great Transition. It appears quite modest in Figure 6(c). However, as Figure 9 makes clear, this "modest difference" reflects hundreds of millions more in hunger over the entire scenario period.

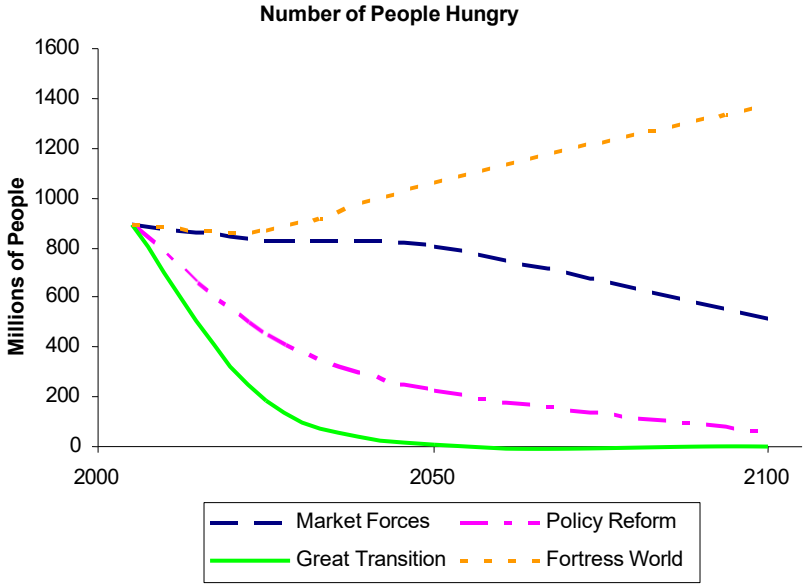


Figure 9. **Number of People Hungry**

The differences in performance on social cohesion and hunger reduction are crucial in shaping the results for the composite indicator for community shown in Figure 6(a). The results are somewhat subtle. Consider Policy Reform. As Figure 6(b) shows, there is no gain in social cohesion. However, there are substantial gains in hunger reduction. It is these gains which account for the gains in the composite shown in Figure 6(a).

Finally, there is environment. In this portion of the QDI the composite indicator shown in Figure 7(a) indicates a split among the scenarios. For Policy Reform and Great Transition, after an initial drop there is a net gain. In contrast, both Market Forces and Fortress World show a substantial decline through 2100 compared to 2005. Turning to the component indicators, one sees that it is habitat, not climate, that contributes most to that decline. The habitat indicator shown in Figure 7(b) drops for all of the scenarios for a number of decades before flattening out for Market Forces and turning upward for the rest. The data for the habitat indicator comes from the land-use module of PoleStar which keeps track of the myriad uses to which land is put: farming, pasture, various forest products, mining, built areas, etc. The acreage required for these uses is subtracted from the fixed global total available and the metric for habitat is the residual. In all of the scenarios the growth in population and income shown in Figures 2(b) and (c) creates an initial need for additional land in the short run (i.e., roughly through 2025), depressing the residual and so creating the "dip" in Figure 7(b). Over the longer term, changes in Policy Reform and Great Transition offset this effect. For Fortress World the lower standard of living for the mass of the population also creates a very modest offset. It is only in Market Forces where the drive for increasing material affluence continues unabated, that there is no offset leading to eventual improvement. A similar story unfolds for the climate indicator. There, however, substantial improvements in efficiency provide an offset in all the scenarios, shifting all the curves upward in Figure 7(c)..

Looking back over the GPI and QDI results, it is fair to ask "what was the value added?" that is to say, what was learned that could not have been foreseen at the outset? The fact that the high-growth Conventional Worlds fared well based on the GDP while the Great Transition did best based on the shift in values reflected in the QDI was not unexpected. However, many of the specific results were somewhat surprising. Return for a moment to Environment. One would not have anticipated the importance of habitat compared to climate in developing the composite. Having seen that result, one is led to consider whether the averaging should be weighted, to put more emphasis on climate as the design of the Ecological Footprint happens to do.

Comparison of the GDP results with those for the QDI, particularly those for well-being and the environment, also provide a number of insights. From the well-being results one sees the importance of the trade-off between time and material affluence. The results for environment show the price one pays, in habitat as well as climate, for continuing pursuit of economic growth, particularly growth in income. Here the results on Community provide a useful additional insight. For a scenario such as Policy Reform, which reduces the number of desperately poor (i.e., hungry) substantially but does little to close the income gap between the OECD and non-OECD nations, those in the non-OECD nations have an increasing ability and, likely, a continuing desire to "catch up" in consumption. This in turn is likely to create substantial pressure on the environment.

It is the emergence of these points and many others like them that demonstrate the value added from head-to-head comparisons based on different indicators, and from the use of a carefully designed, multidimensional indicator such as the QDI.

Concluding Remarks

As an old saying goes, "What gets measured gets done". The de facto adoption of GDP as the headline indicator of progress carries with it an implicit choice of values and an associated approach to important policy issues which deserve careful consideration. What are the values associated with GDP? The basic value is growth itself. This is clear in the way the GDP is used to describe the business cycle. Declines in GDP lasting just half a year (i.e., two quarters) are generally taken to indicate a recession, a development as welcome in the economy as a hurricane is in the weather. Slow growth elicits a similar but weaker response. Growth in GDP per capita, our basic measure of the standard of living, today, has become an accepted focus of government policy. With GDP, in total and per capita, as the key point of concern, other issues such as community (i.e., equity and the fate of those who remain hungry) and the environment, particularly the sustainability of humanity's impact on it, are forced to the margin. Discussion of these concerns is shaped by the need to accommodate unlimited growth. Consider, for example, the *Stern Repo*rt (Stern, 2006). One of its main arguments for action on climate change is that such action will have a modest adverse effect on future economic growth, likely far less than the effect of failure to act. Economic growth, it seems, is essential. The fact that it is consistent with the actions required to keep the earth habitable, allows one to put such action on the agenda.

The values associated with the QDI and their implications for the pursuit of sustainability are quite different. In the QDI individual well-being is given equal weight with community and the environment. In addressing well-being, the declining marginal utility of additional GDP per capita is taken into account as is the trade-off between time and material affluence. If QDI rather than GDP were broadly used and accepted as our headline indicator, the focus would likely shift to time rather than material affluence, particularly in the current high income nations. There would also likely be enhanced interest in income equality within and among nations, and in actions that reduce climate impacts as well as pressures on land resources. This in turn would likely lead to changes in the way policy is developed. Consider a simple example. The OECD currently produces *Going for Growth*, to explain how nations could alter their policies to enhance their GDP per capita. With the QDI as the headline indicator, one can imagine it being replaced by a new publication, perhaps called *Going for a Better Life*, in which policy advice focused on gains in the QDI and its components would be provided instead.

There is no way to know whether, over the long run, the QDI will come to replace GDP as the headline indicator of progress. Whether or not this occurs, its introduction may occasion substantial gains:

- The explicit value basis for the QDI in effect challenges those who use other indicators of progress to identify the values on which they are

based, and to defend their choice compared to the values reflected in the QDI.

- Making the QDI part of the Tellus Framework and conducting a "head-to-head" comparison of results using GDO and QDI puts forth a new, broader and richer approach which similar global scenario-based exercises may adopt.

These developments are less ambitious than replacement of the GDP, but provide stepping stones toward it.

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